

STS 113/11A: Assessment of Air Quality in the International Space Station (ISS) and Space Shuttle Based on Samples Returned in December 2002 and in May 2003 aboard Soyuz 5

The toxicological assessments of grab sample canisters (GSCs) returned aboard STS-113 and Soyuz 5 are reported. Analytical methods have not changed from earlier reports. Surrogate standard recoveries from the GSCs were 79-120% except as noted in the table. One sample was returned with the valve opened.

The two general criteria used to assess air quality are the total-non-methane-volatile organic hydrocarbons (NMVOCs) and the total T-value (minus the CO₂ and formaldehyde contributions). Control of atmospheric alcohols is important to the water recovery system engineers, hence total alcohols (including acetone) are also shown for each sample. Octafluoropropane (OFP) has leaked from heat-exchange units in large quantities, so its concentration is tracked separately. Because formaldehyde is quantified from sorbent badges, its concentration is also listed separately. These five indices of air quality are summarized below:

<u>Sample</u> <u>Location</u>	<u>Date</u>	<u>NMVOCs - OFP</u> (mg/m ³)	<u>OFP</u> (mg/m ³)	<u>T Value</u> ^a (units)	<u>Alcohols</u> (mg/m ³)	<u>Formaldehyde</u> (mg/m ³)
Lab GSC/For.	10/20/02	<i>"defective" sampler</i>				0.055
FGB GSC	10/20/02	11	13	0.57	6.2	ns ^c
SM GSC/For.	10/20/02	<i>valve open upon return to JSC</i>				0.028
Lab GSC	10/21/02	11	16	0.69	5.1	ns
Airlock GSC	10/22/02	9	13	0.55	6.0	ns
Lab GSC/For.	11/15/02	12	12	0.46	8.6	0.046
SM GSC/For.	11/15/02	12	11	0.65	8.2	0.022
Lab GSC ^d	11/29/02	8	4	0.49	3.1	ns
Lab GSC/For.	12/16/02	10	1	0.50	6.0	0.057
SM For.	12/16/02	--	--	--	--	0.027
Lab For.	01/22/03	--	--	--	--	0.057
SM For.	01/22/03	--	--	--	--	0.020
Lab For.	02/26/03	--	--	--	--	0.040
Lab For.	04/02/03	--	--	--	--	0.041
Lab For.	04/23/03	--	--	--	--	0.041
Shuttle Preflight	11/23/02	2	n/a ^b	0.20 ^e	0.5	ns
Shuttle Middeck	12/04/02	11	8	0.58	5.8	ns
Acceptable Guideline:		<25	85000	<1	<5	0.050

^a Formaldehyde and CO₂ not included in T calculation.

^b n/a = not in analysis plan

^c ns = no sample available

^d one surrogate standard was 2 % below the acceptable range

^e The unusually high value was caused by a mixture of aldehydes and ketones found at very low levels in the sample.

The table shows that the air quality in general was acceptable for crew respiration through the middle of December 2002. No conclusions can be made about the air quality after that date due to NASA's inability to return air samples from the ISS. Alcohols are not being controlled to the recently lowered guideline of 5 mg/m³, which was recommended to protect the water recovery systems. The airlock sample was taken during the regeneration of Metox canisters in the adjacent Node. The trace pollutants were not increased above background; however, inspection of table 1 in the appendix shows a CO₂ concentration of 17,000 mg/m³, which is a relatively high concentration, but still below the 24-hour

SMAC of 23,000 mg/m³. The control of OFP continues to be adequate at least through December 2002.

Formaldehyde concentrations suggest that the high levels that were being found in the Lab atmosphere have subsided. This is probably attributable to the restoration of IMV in early February 2003. Before the obstructing material was removed from ducts the Lab formaldehyde concentrations approached 0.06 mg/m³, whereas after the repair the levels were near 0.04 mg/m³. This does not mean that local sources in the Lab have been reduced, only that the excess of formaldehyde produced in the Lab is distributed into the whole volume of the ISS.

Enclosures

- 1: Analytical Results of STS-113/11A and Soyuz 5 GSC Samples
- 2: T Values of STS-113/11A and Soyuz GSC Samples

TABLE 1
ANALYTICAL RESULTS OF
ISS 11A, SOYUZ 5, AND STS-113 CONTAINER AIR SAMPLES

CHEMICAL CONTAMINANT	CONCENTRATION (mg/m ³)								
	AA03511 SN1072 FGB 10/20/2002 21:41GMT	AA03513 SN1007 LAB 10/21/2002 10:58GMT	AA03509 SN1071 Airlock 10/22/2002 20:55GMT	AA03514 SN1046 Lab 11/15/2002 03:33GMT	AA03515 SN1082 Service Module 11/15/2002 03:37GMT	AA03516 SN1076 LAB 11/29/2002 22:52GMT	AA03533 SN1016 LAB 12/16/2002 09:00GMT	AA03506 SN1015 Preflight 11/23/2002 14:30EST	AA03508 SN1063 Middeck 12/04/2002 15:30GMT
TARGET COMPOUNDS (TO-14/POLAR)***									
FREON 12	TRACE	TRACE	TRACE	TRACE	TRACE	0.08	0.41	<0.05	0.07
CHLOROMETHANE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	TRACE	<0.05	TRACE
FREON 114	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
METHANOL	0.59	0.41	0.44	0.47	1.53	0.45	0.44	TRACE	1.48
ACETALDEHYDE	0.21	0.24	0.23	0.25	0.48	0.23	0.22	0.20	0.23
VINYL CHLORIDE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
BROMOMETHANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ETHANOL	4.83	4.06	4.52	7.26	5.96	2.19	4.80	0.05	4.08
CHLOROETHANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ACETONITRILE	TRACE	TRACE	TRACE	<0.05	TRACE	0.07	TRACE	<0.05	TRACE
PROPENAL	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ACETONE	0.29	0.20	0.26	0.22	0.37	0.22	0.35	0.32	0.18
PROPANAL	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	0.10	TRACE
2-PROPANOL	0.27	0.22	0.58	0.12	0.10	0.19	0.18	TRACE	TRACE
FREON 11	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	<0.05
FURAN	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ACRYLONITRILE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	TRACE	<0.05	<0.05
PENTANE	<0.05	<0.05	<0.05	<0.05	<0.05	TRACE	<0.05	<0.05	<0.05
2-METHYL-2-PROPANOL	TRACE	TRACE	TRACE	<0.05	TRACE	TRACE	<0.05	<0.05	TRACE
METHYL ACETATE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,1-DICHLOROETHENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
DICHLOROMETHANE	0.13	0.16	0.20	0.15	0.14	0.10	0.29	<0.05	0.09
3-CHLOROPROPENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
FREON 113	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
N-PROPANOL	0.10	0.06	0.09	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05
1,1-DICHLOROETHANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
BUTANAL	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	0.08	<0.05
2-BUTANONE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	0.16	TRACE
1,2-DICHLOROETHENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-METHYLFURAN	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ETHYL ACETATE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	<0.05
HEXANE	<0.05	<0.05	<0.05	<0.05	<0.05	TRACE	<0.05	<0.05	<0.05
CHLOROFORM	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-BUTENAL	<0.05	<0.05	<0.05	<0.05	TRACE	<0.05	<0.05	TRACE	<0.05
1,2-DICHLOROETHANE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	TRACE	<0.05	<0.05
1,1,1-TRICHLOROETHANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
N-BUTANOL	0.16	0.12	0.16	0.49	0.21	TRACE	0.18	TRACE	TRACE
BENZENE	<0.05	<0.05	TRACE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
CARBON TETRACHLORIDE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-PENTANONE	TRACE	TRACE	<0.05	TRACE	TRACE	<0.05	TRACE	0.12	<0.05
PENTANAL	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	0.08	<0.05
1,2-DICHLOROPROPANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,4-DIOXANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TRICHLOROETHENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	TRACE	<0.05
2,5-DIMETHYLFURAN	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
4-METHYL-2-PENTANONE	<0.05	TRACE	<0.05	TRACE	TRACE	<0.05	TRACE	TRACE	<0.05
CIS-1,3-DICHLOROPROPENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
2-PENTENAL	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TRANS-1,3-DICHLOROPROPENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,1,2-TRICHLOROETHANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
TOLUENE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05
HEXANAL	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	0.07	TRACE
MESITYL OXIDE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	TRACE	<0.05
1,2-DIBROMOETHANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
BUTYL ACETATE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	<0.05	<0.05	<0.05
TETRACHLOROETHENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
CHLOROBENZENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ETHYL BENZENE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	<0.05	<0.05	<0.05
M- + P-XYLENES	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	<0.05
2-HEPTANONE	TRACE	TRACE	<0.05	TRACE	TRACE	<0.05	<0.05	0.07	<0.05
CYCLOHEXANONE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05
HEPTANAL	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	0.08	TRACE
STYRENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,1,2,2-TETRACHLOROETHANE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
O-XYLENE	0.08	TRACE	TRACE	TRACE	0.07	TRACE	TRACE	<0.05	<0.05
1,3,5-TRIMETHYLBENZENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,2,4-TRIMETHYLBENZENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,3-DICHLOROBENZENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,4-DICHLOROBENZENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,2-DICHLOROBENZENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
1,2,4-TRICHLOROBENZENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
HEXACHLORO-1,3-BUTADIENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

TABLE 1
ANALYTICAL RESULTS OF
ISS 11A, SOYUZ 5, AND STS-113 CONTAINER AIR SAMPLES

CHEMICAL CONTAMINANT	CONCENTRATION (mg/m3)								
	AA03511 SN1072 FGB 10/20/2002 21:41GMT	AA03513 SN1007 LAB 10/21/2002 10:58GMT	AA03509 SN1071 Airlock 10/22/2002 20:55GMT	AA03514 SN1046 Lab 11/15/2002 03:33GMT	AA03515 SN1082 Service Module 11/15/2002 03:37GMT	AA03516 SN1076 LAB 11/29/2002 22:52GMT	AA03533 SN1016 LAB 12/16/2002 09:00GMT	AA03506 SN1015 Preflight 11/23/2002 14:30EST	AA03508 SN1063 Middeck 12/04/2002 15:30GMT
TARGET COMPOUNDS (TOXIC)									
1,3-BUTADIENE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ETHYLENE OXIDE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
CARBON DISULFIDE	TRACE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	<0.05	<0.05
2-METHYL-2-PROPENAL	<0.05	<0.05	TRACE	<0.05	TRACE	<0.05	<0.05	TRACE	<0.05
3-BUTEN-2-ONE	TRACE	TRACE	TRACE	TRACE	TRACE	<0.05	<0.05	TRACE	<0.05
2-ETHOXYETHANOL	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
DIMETHYLDISULFIDE	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
OCTAMETHYLCYCLOTETRAILOXANE	0.87	1.29	0.27	0.45	0.57	0.99	0.93	TRACE	0.07
NON-TARGET COMPOUNDS									
OCTAFLUOROPROPANE	13	16	13	12	11	4	1	NA	8
BROMOTRIFLUOROMETHANE	0.020	0.020	0.014	BL	BL	0.046	BL	BL	0.69
C4-ALKENE	BL	BL	BL	BL	BL	BL	0.023	BL	BL
2-METHYL-PROPANE	0.021	0.020	0.028	0.019	0.030	0.01	0.01	BL	BL
TRIMETHYLSILANOL	0.070	0.13	0.30	0.12	0.068	0.023	0.099	BL	0.004
HEXAMETHYLCYCLOTETRAILOXANE	1.3	2.3	0.45	0.89	0.74	1.8	1.6	0.045	0.093
C8-KETONE	BL	0.006	BL	BL	BL	BL	BL	0.24	BL
LIMONENE	0.068	0.047	0.036	0.063	0.13	0.011	BL	BL	0.011
DECAMETHYLCYCLOPENTASILOXANE	1.1	0.78	0.82	0.52	0.42	0.64	0.46	0.020	4.2
TOTAL ALCOHOLS PLUS ACETONE	6.2	5.1	6.0	8.6	8.2	3.1	6.0	0.5	5.8
TARGET COMPOUNDS (GC)***									
CARBON MONOXIDE	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	3.0
METHANE	24	21	25	23	28	15	NA	TRACE	120
HYDROGEN	<0.7	2.0	1.3	1.4	2.3	<0.7	NA	<0.7	4.9
CARBON DIOXIDE	10000	9700	17000	13000	12000	4300	9700	1300	4900
TOTAL CONCENTRATION (NON-METHANE HYDROCARBONS)	23.9	26.7	22.0	23.6	22.5	11.5	11.5	2.0	19.4

NA : Value Not Available

< : Value is less than the laboratory report detection limit.

TRACE: Amount detected is sufficient for compound identification only. Calculations are based on one-half of the laboratory report detection limit (1.1 mg/m3 for CO; 0.2 mg/m3 for CH4; 1.6 mg/m3 for H2; 0.05 mg/m3 for VOCs; and 0.02 mg/m3 for propenal.)

BL: Area below the search routine limit (<20% of the fluorobenzene peak area).

***Measurements are calibrated by multi-point initial calibration and verified by mid-point continuing calibration.

NOTE: High levels (above 1.5ppm) of Methanol, Ethanol, Acetone, Isopropanol and 2-Butanone are routinely reported based on calibrated GC-FID measurements.

TABLE 2
ANALYTICAL RESULTS OF
ISS 11A, SOYUZ 5, AND STS-113 CONTAINER AIR SAMPLES

CHEMICAL CONTAMINANT	T-VALUE (180-d SMAC)								T-VALUE (7-d SMAC)	
	AA03511 SN1072 FGB 10/20/2002 21:41GMT	AA03513 SN1007 LAB 10/21/2002 10:58GMT	AA03509 SN1071 Airlock 10/22/2002 20:55GMT	AA03514 SN1046 Lab 11/15/2002 03:33GMT	AA03515 SN1082 Service Module 11/15/2002 03:37GMT	AA03516 SN1076 LAB 11/29/2002 22:52GMT	AA03533 SN1016 LAB 12/16/2002 09:00GMT	AA03506 SN1015 Preflight 11/23/2002 14:30EST	AA03508 SN1063 Middeck 12/04/2002 15:30GMT	
TARGET COMPOUNDS (TO-14/POLAR)***										
FREON 12	0.00005	0.00005	0.00005	0.00005	0.00005	0.00017	0.00086	ND	0.00014	
CHLOROMETHANE	0.00061	0.00061	0.00061	0.00061	0.00061	ND	0.00061	ND	0.00061	
FREON 114	ND	ND	ND	ND	ND	ND	ND	ND	ND	
METHANOL	0.06609	0.04571	0.04906	0.05182	0.16987	0.05022	0.04933	0.00278	0.16405	
ACETALDEHYDE	0.05358	0.06124	0.05809	0.06169	0.12023	0.05764	0.05417	0.05040	0.05854	
VINYL CHLORIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
BROMOMETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
ETHANOL	0.00242	0.00203	0.00226	0.00363	0.00298	0.00109	0.00240	0.00003	0.00204	
CHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
ACETONITRILE	0.00373	0.00373	0.00373	ND	0.00373	0.01097	0.00373	ND	0.00373	
PROPENAL	ND	ND	ND	ND	ND	ND	ND	ND	ND	
ACETONE	0.00553	0.00384	0.00502	0.00429	0.00703	0.00416	0.00664	0.00620	0.00352	
PROPANAL	0.00694	0.00694	0.00694	0.00694	0.00694	0.00694	0.00694	0.00726	0.00175	
2-PROPANOL	0.00177	0.00144	0.00385	0.00077	0.00067	0.00127	0.00118	0.00017	0.00017	
FREON 11	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	ND	ND	
FURAN	ND	ND	ND	ND	ND	ND	ND	ND	ND	
ACRYLONITRILE	0.00893	0.00893	0.00893	0.00893	0.00893	ND	0.00893	ND	ND	
PENTANE	ND	ND	ND	ND	ND	0.00004	ND	ND	ND	
2-METHYL-2-PROPANOL	0.00021	0.00021	0.00021	ND	0.00021	0.00021	ND	ND	0.00017	
METHYL ACETATE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
1,1-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
DICHLOROMETHANE	0.01311	0.01593	0.02038	0.01512	0.01435	0.00955	0.02858	ND	0.00185	
3-CHLOROPROPENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
FREON 113	ND	ND	ND	ND	ND	ND	ND	ND	ND	
N-PROPANOL	0.00105	0.00064	0.00088	0.00026	0.00026	0.00026	0.00026	0.00026	ND	
1,1-DICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
BUTANAL	0.00568	0.00568	0.00568	0.00568	0.00568	0.00568	0.00568	0.00433	ND	
2-BUTANONE	0.00083	0.00083	0.00083	0.00083	0.00083	0.00083	0.00083	0.00540	0.00083	
1,2-DICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
2-METHYLFURAN	ND	ND	ND	ND	ND	ND	ND	ND	ND	
ETHYL ACETATE	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014	0.00014	ND	ND	
HEXANE	ND	ND	ND	ND	ND	0.00014	ND	ND	ND	
CHLOROFORM	ND	ND	ND	ND	ND	ND	ND	ND	ND	
2-BUTENAL	ND	ND	ND	ND	0.01471	ND	ND	0.01471	ND	
1,2-DICHLOROETHANE	0.02500	0.02500	0.02500	0.02500	0.02500	ND	0.02500	ND	ND	
1,1,1-TRICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
N-BUTANOL	0.00409	0.00294	0.00394	0.01235	0.00535	0.00063	0.00458	0.00031	0.00031	
BENZENE	ND	ND	0.12500	ND	ND	ND	ND	ND	ND	
CARBON TETRACHLORIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
2-PENTANONE	0.00036	0.00036	ND	0.00036	0.00036	ND	0.00036	0.00165	ND	
PENTANAL	0.00472	0.00472	0.00472	0.00472	0.00472	0.00472	0.00472	0.00372	ND	
1,2-DICHLOROPROPANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
1,4-DIOXANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TRICHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	0.00050	ND	
2,5-DIMETHYLFURAN	ND	ND	ND	ND	ND	ND	ND	ND	ND	
4-METHYL-2-PENTANONE	ND	0.00018	ND	0.00018	0.00018	ND	0.00018	0.00018	ND	
CIS-1,3-DICHLOROPROPENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
2-PENTENAL	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TRANS-1,3-DICHLOROPROPENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
1,1,2-TRICHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
TOLUENE	0.00042	0.00042	0.00042	0.00042	0.00042	0.00042	0.00042	0.00042	ND	
HEXANAL	0.00410	0.00410	0.00410	0.00410	0.00410	0.00410	0.00410	0.00299	0.00102	
MESITYL OXIDE	ND	ND	ND	ND	ND	ND	ND	0.00063	ND	
1,2-DIBROMOETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
BUTYL ACETATE	0.00013	0.00013	0.00013	0.00013	0.00013	ND	ND	ND	ND	
TETRACHLOROETHENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
CHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
ETHYL BENZENE	0.00050	0.00050	0.00050	0.00050	0.00050	ND	ND	ND	ND	
M- + P-XYLENES	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	0.00011	ND	ND	
2-HEPTANONE	0.00109	0.00109	ND	0.00109	0.00109	ND	ND	0.00291	ND	
CYCLOHEXANONE	0.00042	0.00042	0.00042	0.00042	0.00042	0.00042	0.00042	0.00042	ND	
HEPTANAL	0.00357	0.00357	0.00357	0.00357	0.00357	0.00357	0.00357	0.00294	0.00089	
STYRENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
1,1,2,2-TETRACHLOROETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
O-XYLENE	0.00036	0.00011	0.00011	0.00011	0.00034	0.00011	0.00011	ND	ND	
1,3,5-TRIMETHYLBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
1,2,4-TRIMETHYLBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
1,3-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
1,4-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
1,2-DICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
1,2,4-TRICHLOROBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	
HEXACHLORO-1,3-BUTADIENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	

TABLE 2
ANALYTICAL RESULTS OF
ISS 11A, SOYUZ 5, AND STS-113 CONTAINER AIR SAMPLES

CHEMICAL CONTAMINANT	T-VALUE (180-d SMAC)							T-VALUE (7-d SMAC)	
	AA03511 SN1072 FGB 10/20/2002 21:41GMT	AA03513 SN1007 LAB 10/21/2002 10:58GMT	AA03509 SN1071 Airlock 10/22/2002 20:55GMT	AA03514 SN1046 Lab 11/15/2002 03:33GMT	AA03515 SN1082 Service Module 11/15/2002 03:37GMT	AA03516 SN1076 LAB 11/29/2002 22:52GMT	AA03533 SN1016 LAB 12/16/2002 09:00GMT	AA03506 SN1015 Preflight 11/23/2002 14:30EST	AA03508 SN1063 Middeck 12/04/2002 15:30GMT

TARGET COMPOUNDS (TOXIC)									
1,3-BUTADIENE	ND	ND	ND	ND	ND	ND	ND	ND	ND
ETHYLENE OXIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND
CARBON DISULFIDE	0.00156	0.00156	0.00156	0.00156	0.00156	0.00156	ND	ND	ND
2-METHYL-2-PROPENAL	ND	ND	0.01471	ND	0.01471	ND	ND	0.01471	ND
3-BUTEN-2-ONE	0.05814	0.05814	0.05814	0.05814	0.05814	ND	ND	0.05814	ND
2-ETHOXYETHANOL	ND	ND	ND	ND	ND	ND	ND	ND	ND
DIMETHYLDISULFIDE	ND	ND	ND	ND	ND	ND	ND	ND	ND
OCTAMETHYLCYCLOTETRAILOXANE	0.07252	0.10756	0.02266	0.03770	0.04767	0.08273	0.07766	0.00009	0.00024

NON-TARGET COMPOUNDS									
OCTAFLUOROPROPANE	0.00016	0.00019	0.00016	0.00014	0.00013	0.00005	0.00001	NA	0.00010
BROMOTRIFLUOROMETHANE	0.00000	0.00000	0.00000	BL	BL	0.00000	0.00000	0.00000	0.00006
C4-ALKENE	BL	BL	BL	BL	BL	BL	0.00010	BL	BL
2-METHYL-PROPANE	0.00009	0.00008	0.00012	0.00008	0.00012	0.00004	0.00003	0.00000	0.00000
TRIMETHYLSILANOL	0.00189	0.00354	0.00798	0.00316	0.00184	0.00062	0.00268	0.00000	0.00011
HEXAMETHYLCYCLOTETRAILOXANE	0.14367	0.25325	0.04958	0.09849	0.08171	0.19524	0.17946	0.00050	0.00104
C8-KETONE	BL	0.00023	BL	BL	BL	BL	0.00000	0.00930	0.00000
LIMONENE	0.00012	0.00008	0.00006	0.00011	0.00024	0.00002	0.00000	0.00000	0.00002
DECAMETHYLCYCLOPENTASILOXANE	0.07475	0.05210	0.05460	0.03480	0.02769	0.04267	0.03066	0.00013	0.02805

TARGET COMPOUNDS (GC)***									
CARBON MONOXIDE	ND	ND	ND	ND	ND	ND	ND	ND	0.27071
METHANE	0.00639	0.00552	0.00656	0.00604	0.00742	0.00397	NA	0.00019	0.03108
HYDROGEN	ND	0.00582	0.00388	0.00412	0.00679	ND	NA	ND	0.01430
CARBON DIOXIDE	0.77520	0.74751	1.32891	1.01053	0.91363	0.33223	0.74751	0.09690	0.37376

TOTAL T-VALUE	1.35006	1.43723	1.88364	1.46872	1.56517	0.82256	1.25200	0.28812	0.95908
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NA : Value Not Available

ND : Value is less than the laboratory report detection limit.

BL: Area below the search routine limit (< 20% of the fluorobenzene peak area).

Note: Number of decimal places in T-Values do not represent significant figures of measurements.

***Measurements are calibrated by multi-point initial calibration and verified by mid-point continuing calibration.